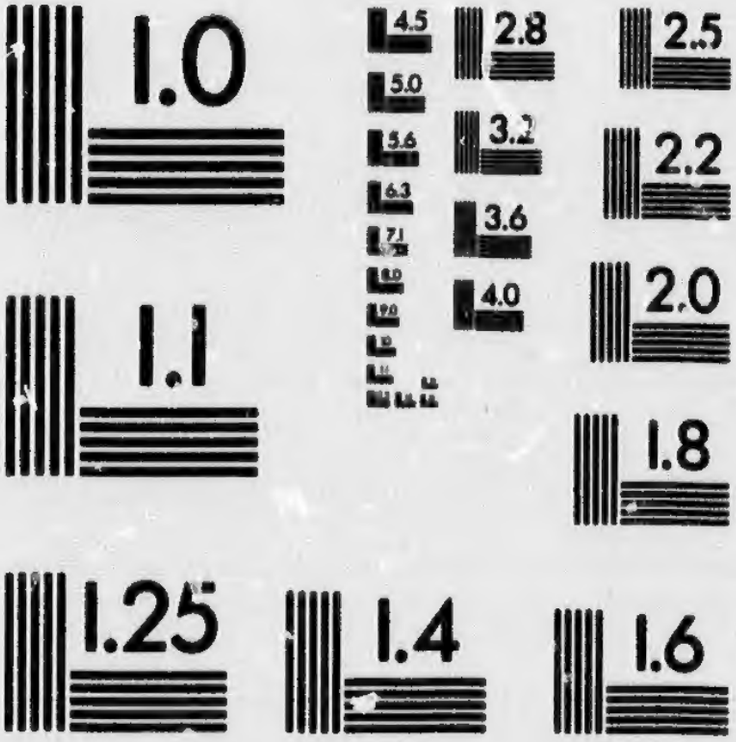
MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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A REPORT

UPON

ROAD MAKING,

AND TUNNELING,

ACCOMPANYING SECTIONS.

BY JAMES CANE,

CIVIL ENGINEER.

Montreal:

PRINTED BY LOVELL & GIBSON, ST. NICHOLAS STREET.

1845.

PREFACE.

It is my intention to submit to the public, the last day of each month, a short treatise on the different branches of my profession, and I am induced to submit my first upon Road-making and Tunneling to the notice of the Corporation of Montreal, accompanied with a Section of a Road and Culverts. It is the system upon which several Roads and Tunnels have been constructed, upon which I have been employed as Surveyor, and which has fully turned out to the satisfaction of the Commissioners and Trustees, and the mode is that adopted by the late eminent Mr. Telford. As it is in contemplation by the Corporation to extend the roads as far as the limits of the City will allow, I hope the following few general remarks may not be thought unworthy of the notice of the *Committee of Roads and Improvements*, to whom I beg to subscribe myself,

Their very obedient servant,

JAMES CANE,

Civil Engineer.

REPORT.

Shape or Transverse Section.

The Roadway should be thirty six feet broad; the centre should be six inches higher than the level of the sides, where the junction of the surface with the sloping edge of the footpaths, or other defining bounds of the roadway, from the side channels, at four feet from the centre (on each side.) The surface should be half an inch lower; at nine feet, it should be two inches lower; and at fifteen feet, its extreme edge, it should be six inches lower; this will give the form of a flat ellipse, which is well adapted for carrying off the water to the side channels, without making the cross section of the road too round, and allows the sun and wind to have a greater effect in evaporation and keeping the road dry.

The footpaths should be eight feet broad, and should have an inclined surface of one inch in a yard towards the road; its surface should not be lower than the centre of the road, and the edge should be sloped down, to meet the roadway, and form the side channel, to carry off the water from the surface.

Drainage.

All open main drains should be cut on the field side of the road fences, and should lead to some natural water course; in general they should be three feet deep below the bed of the road, one foot wide at bottom, and from

three to four feet wide at top; stone drains and culverts should also be made under the road, and continued to the open side drains, or ditches; side channels must be made on the road side, with openings of masonry into the cross drains, to prevent any water lying on the road; it being necessary, in order to preserve the surface of a road perfect, that it be completely dry; all land springs ought to be carried from the side of the road by under draining.

Fences.

All road fences should be kept as low as possible, never being allowed to exceed five feet in height, in order not to intercept the sun and wind, and diminish their effects in producing evaporation, and for the same reason no trees, if possible, should be allowed to grow by the side of the road, for by keeping the roads wet, they occasion the rapid wear of the materials of which they are formed.

Road Materials.

The hardest description of stone should always be preferred; when the material is stone they should be broken to a size, of a cubical form; not exceeding $2\frac{1}{2}$ inches in their largest dimensions, and should be capable of passing through a ring of that diameter; when it consists of gravel the pebbles which are from 1 to $1\frac{1}{2}$ inches in size only, should be used for the middle part of the road, all larger pebbles should be broken; the smaller stones should be used for the sides of the roads and the footpaths.

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The Foundation and Disposition of Materials.

Before the foundation is laid, the surface on which it is to rest must be prepared, by making it level from side to side, and, if necessary, raising it so that the finished surface of the road may not be below the level of the adjoining fields. If the subsoil be wet and elastic, it must be rendered non-elastic, by whatever means is best adapted to overcome the cause, as drainage, &c. The foundation should consist of a rough close-set pavement, of any kind of stones that can be most readily procured; those set in the middle of the road should be 7 inches in depth; at 9 feet from the centre, 5 inches; at 12 feet from the centre, 4 inches; and at 15 feet, 3 inches. They should be set with the broadest faces downwards, and lengthwise across the road; and no stone should be more than 5 inches broad on its face.

The irregularities of the upper part of the pavement should be broken off with the hammer, and all the interstices should be filled with stone chips, firmly wedged, or packed by hand with a light hammer; so that, when the pavement is finished, there may be a convexity of 4 inches in the breadth of 15 feet from the centre.

The middle 18 feet of pavement should be coated with hard broken stones, of the form and size described under the head of "Road Materials," to the depth of six inches. Four of these 6 inches to be first put on, and worked in by carriages and horses; care being taken to rake in the ruts until the surface becomes firm and consolidated, after which the remaining 2 inches are to be put on.

The paved spaces on each side of the 18 middle feet should be coated with broken stones, or well cleansed strong gravel, up to the foot-path, or boundary of the road, so as to make the whole convexity of the road 6 inches from the centre to the sides of it, and the whole of the materials should be covered with a binding of an inch and a half in depth of good gravel, free from clay or earth.

The footpaths should be made with a coating of strong gravel or small broken stones, at least six inches deep. But should the footpaths be formed of wood, I should recommend the mode usually adopted by the present City Surveyor, Mr. Ostell.

TUNNELS.

Foundations.

There is no portion of the work, in the formation of a tunnel, that requires so much attention as that of the foundation; where the Engineer has to bore or excavate through sand or other light strata, where this occurs I would strongly recommend the use of *Concrete.*

Nature of Concrete.

In forming this Concrete, a mortar is made by mixing three parts of sand with one of hydraulic lime, and then mixing about three parts of stone, broken to a size allowing them to pass through a ring an inch and a half in diameter; having thoroughly mingled the broken stone and mortar, the Concrete is placed in its proper position and form, and brought into a compact state by using a

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pounder; and is then suffered to remain until it set, or becomes indurated, before any work is commenced upon it. The object should be to mix as many stones or pebbles as will thoroughly bed in the mortar; this forms a body which becomes indurated, and makes a foundation under the whole length of the tunnel, like one continuous stone. It attains a degree of hardness which gives it the appearance of the conglomorate, bearing the name of Pudding Stone. This description of foundation supersedes in many instances, where the soil is soft, the use of Piles or other timber foundation.

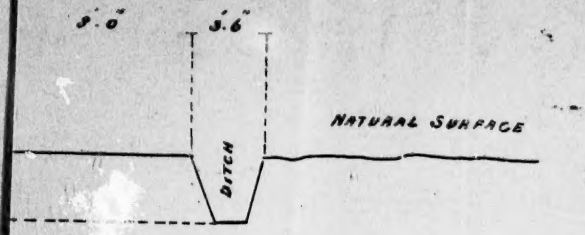
Quality of Brick.

The Bricks which should be used in this description of work, ought to be of a different character from those used in ordinary House Building; being harder burnt and of a superior quality of material.

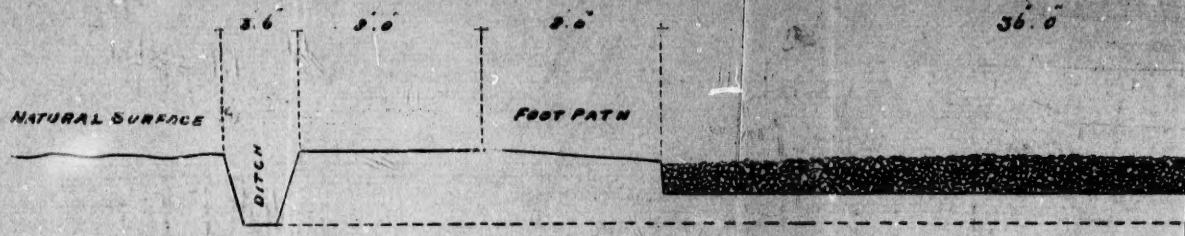
They are required to be burnt to such a degree of hardness that they present a cherry red or brownish color, and give a clear ringing sound when struck; and when broken must present a compact and uniform texture; all bricks which are soft and of a pale color, which are usually denominated Salmon Brick, ought to be rejected; those which should be used possess nearly the hardness and durability of ordinary building stone, and are calculated to resist the action of the water, to which they will be exposed.

Proportion of Mortar.

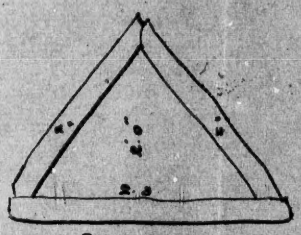
The proportion of the mortar for the brick work, ought to be two parts of sand to one of hydraulic lime.



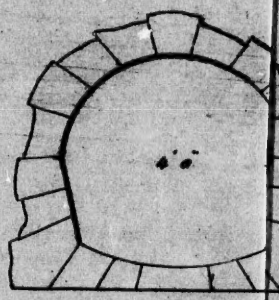
James Lowe
Civil Engineer
24 Jan 1845



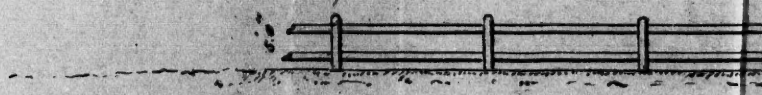
TRANVERSE SECTION
OF ROADWAY



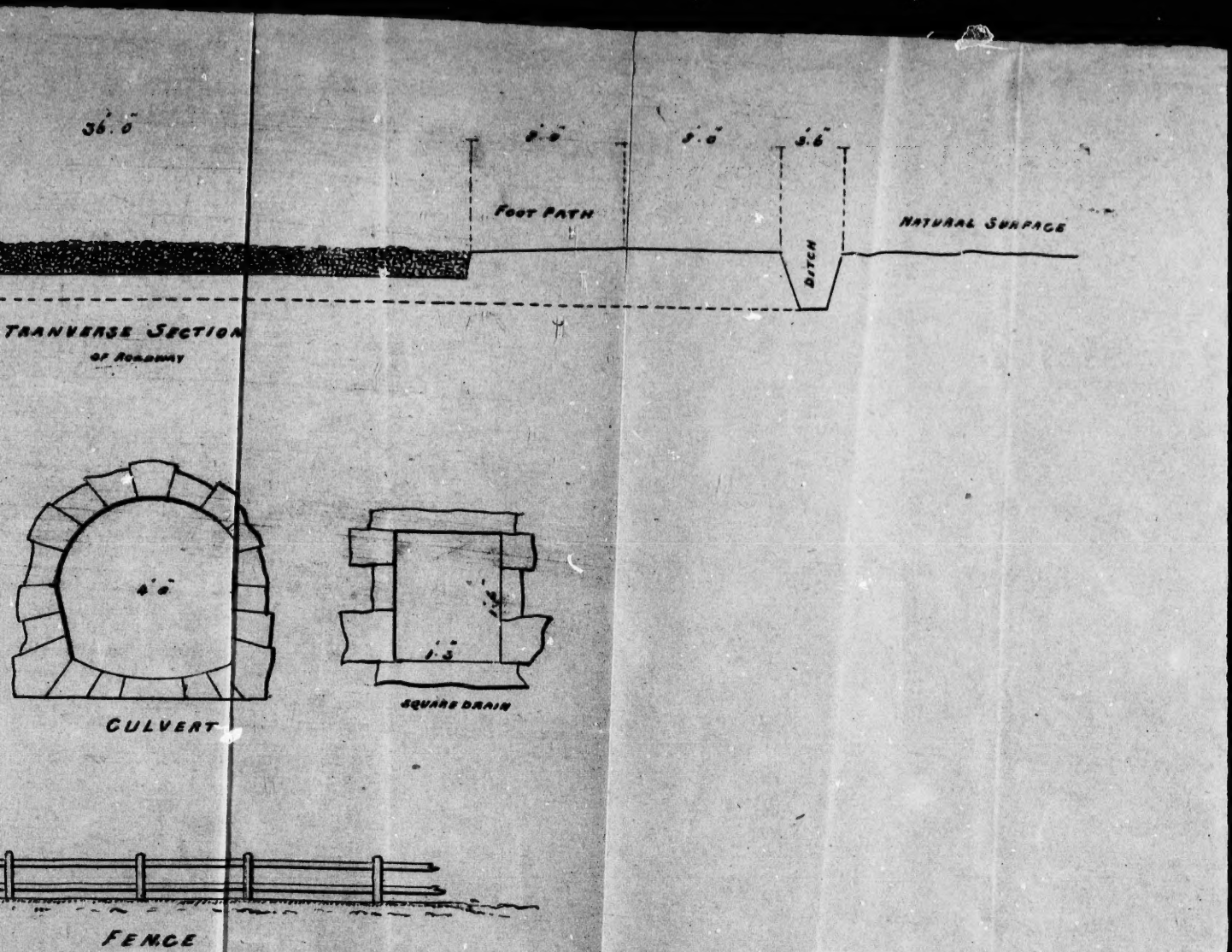
SLAB DRAIN



CULVERT



FENCE



James Lyle
Civil Engineer
24 Jan 1845